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Original Research

Magnitude and determinants of uncontrolled blood pressure among hypertensive patients in Ethiopia: hospital-based observational study

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Abstract

Background: Hypertension is an important public health problem worldwide. There is lack of data on uncontrolled blood pressure in developing countries.

Objectives: To determine the magnitude and predicting factors of uncontrolled blood pressure in hypertensive patients attending Gondar university hospital, Ethiopia.

Methods: A hospital-based cross-sectional survey was conducted from July 2015 to March 2016. All hypertensive patients were followed and the blood pressure levels were measured. Binary logistic regression analysis was done to determine the predictors of uncontrolled blood pressure. A p-value of <0.05 was set at priori with 95% confidence interval to test the level of significance.

Results: Of the total 578 hypertension patients, 543 (93.9%) fulfilled the study criteria and were included in the final analysis. The mean age of the participants was 55.96±14.6 years. Nearly two-third (58.2%) of the participants were females. More than one-tenth (11.4%) of the respondents had uncontrolled blood pressure. High salt intake carried six times more risk of uncontrolled blood pressure. Elderly individuals had lower risk as compared to young age group. However, comorbidities were not related with uncontrolled blood pressure.

Conclusions: Blood pressure control was relatively high in the hospital studied. High salt intake was strongly linked with uncontrolled blood pressure. Individuals with high salt intake should be followed for their medication experience and disease knowledge.

Keywords

Hypertension; Risk Factors; Sodium Chloride, Dietary; Dietary Approaches To Stop Hypertension; Diet, Sodium-Restricted; Blood Pressure; Cross-Sectional Studies; Ethiopia

INTRODUCTION

Hypertension (HTN) is an important public health problem worldwide. According to the Report of the Joint National Committee on Prevention, Detection and Evaluation of High Blood Pressure JNC-7, hypertension is said to be uncontrolled when the blood pressure (BP) exceeds 140/90 mmHg. The targets BP should be below 130/80 mmHg patients with diabetes mellitus (DM) and chronic kidney disease (CKD).¹ Therefore, uncontrolled blood pressure (UBP) occur when these target are not achieved. Attaining the goal of optimal medication therapy is difficult for most chronic diseases including HTN.² It is evident in previous study that in spite of accessible therapeutic alternatives, blood pressure remained above the cut-off point (140/90) in large number of hypertensive patients in Ethiopia.³ A report from Center for Disease Prevention and Control (CDC) found that the rate of UBP approached to 53.5% in United States of America (USA).⁴ A meta-analysis also

showed that in most sub-Saharan Africa (SSA), the control of BP to the target level (140/90) was less than 30%.⁵ However, a recent study done in Addis Ababa, Ethiopia, reported that approximately 60% hypertensive patients achieved target BP level.⁶

UBP predisposes patients to cardiovascular, cerebrovascular and renal events. It is an independent risk factor for cardiovascular and cerebrovascular accidents.⁷ According to a World Health Organization (WHO) report, about more than one-half of cardiovascular diseases (CVD) and three-fourth of strokes are consequences of high BP.⁸ It was estimated that 62% of cerebrovascular disease and approximately half of ischemic heart disease were attributable to elevated BP worldwide.⁹ The magnitude of UBP is becoming of public health importance in developing countries including Ethiopia as evidenced by study findings.¹⁰⁻¹³

A review on HTN in developing countries cited a number of factors related to its prevalence including urbanization, ageing of population and social stress. Reasons for BP control in these countries were discussed in the review. These included problems including poverty, limited access to health facilities and high cost of medicines in addition to problems in dietary habits.¹⁴

Studies have shown that, multiple factors were found to contribute for inadequate HTN control. Particularly, non-adherence is a potentially modifiable risk factor that affects BP control.¹⁵⁻¹⁷ Other factors such as male sex, age and

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comorbidities specifically DM were associated with elevated BP.¹⁸

In order to achieve optimal BP level, various types of alternatives have been investigated. Long-term randomized controlled trials (RCTs) have shown that incidence of cardiovascular accidents were significantly reduced due to the appropriate use of antihypertensive drug therapy (AHT) with the correct dose, frequency and duration.¹⁹ The application of proper lifestyle instructions such as exercise and diet were supposed to work along with or in place of medical therapy.^{20,21} However, these interventions might not be thoroughly implemented by the patient due to compliance issues.^{22,23} Furthermore, hypertension may occur as a coincidence or as a complication to other comorbidities, which demand strong BP control. In such instances, the achievement of tight control of BP is difficult as compared to other hypertensive cases.²⁴

Therefore, adequate control of BP requires the identification of factors associated with uncontrolled hypertension. To our best knowledge there is lack of data on the exposing factors for UBP in our population. Few community based studies if any, focus on the level and determinants of adherence to antihypertensive medications.²⁵ Thus, this study aims to comprehensively assess the magnitude and the predictors of UBP in hypertensive patients attending the outpatient department of Gondar University Hospital (GUH), Ethiopia.

METHODS

Study setting and period

The study was conducted in GUH outpatient department from July 1, 2015 to March 30, 2016. GUH is located in Gondar town which is found in the northwestern part of Ethiopia. It is a referral and teaching hospital with a catchment population of more than 5 million. The outpatient department of the hospital comprises medical outpatient department (OPD) and chronic illness wards. The chronic disease ward is composed of cardiovascular, asthma, DM and CKD units. HTN is the most common disease among cardiovascular cases seen in the hospital. Hence, frequent appointments are arranged to follow high turnover of patients.

Study design

A hospital-based cross-sectional survey was conducted in GUH outpatient department.

A total of 578 hypertensive patients who were available during the study period (from July 1, 2015 to March 30, 2016) were screened for eligibility. Of these, 543 patients satisfied the inclusion criteria and were considered for the study.

Inclusion and exclusion criteria

All adult hypertensive patients who did have follow-up at GUH during the study period and willing to participate were included. Patients who didn't started medication atleast a month before and had irregular follow-up were excluded.

Variables

The dependent variable in the study was the level of BP of patients in their last follow-up. The independent variables included age, sex, comorbidity, level of adherence, dose of medications number of regimens and salt intake of patients.

Data collection procedure

Data was collected by all investigators who have been working as mentors and clinical pharmacists at the emergency and ambulatory wards of GUH. A structured questionnaire was prepared to collect all relevant information. Patients' medical records were reviewed to retrieve the sociodemographic data. Supplementary information was taken from physicians when they take histories from patients. The BP goal was set 140/90 mmHg for most hypertensive patients and 130/80 mmHg for patient with CKD and DM.¹ The level of adherence of patients and the amount of dose of the antihypertensive medication were assessed routinely by the follow-up physicians. Low dose of antihypertensive medication was identified referring to physicians' orders and comparing the dose with a standard stated in national treatment guideline.²⁶ Adherence of patients towards their medication was measured by the number of pills they brought back with them (pill count). Adherence by pill count was considered to be achieved if 80% to 100% of the prescribed pills were not returned to the clinic/ pharmacy during refill. The results of the assessment were documented and kept inside locked box to maintain confidentiality.

BP measurement procedure

The BP was measured by senior physician who followed hypertensive patients during their office visit. Patients were allowed to relax for 5 minutes before the first reading of BP. Patients assume upright position in such a way that their upper arm is at their heart level. They were also told not to take tea or coffee. Excess clothing that might affect the BP cuff was removed. Patients were kept calm during BP measurement. The proper BP cuff size that fit with individual patient's arm was selected. The BP cuff has inflated enough to stop blood flow until no sounds was heard through the stethoscope. Then the cuff deflates slowly to measure the systolic and diastolic BP. Three readings were taken and average of the readings was considered for data analysis.²⁷

Salt intake measurement

The extent of salt intake was measured based on WHO recommendations. Accordingly, optimal salt intake is defined as consumption below 5gram per day or equivalent to one teaspoon full. High salt intake represents a daily salt consumption of more than one teaspoonful or 5gram per day. Patients were told to report their salt consumption in terms of gram or teaspoon based on their level of understanding.²⁸

Ethics approval and consent to participate

The study protocol was approved by the Institutional ethical committee from School of Pharmacy, University of Gondar (UoG). Verbal consent was obtained from

Variables	Num. patients (%)
Sex	
Female	316 (58.2)
Male	227 (41.8)
Age	
21-30	24 (4.4)
31-40	66 (12.4)
41-50	86 (15.8)
51-60	143 (26.3)
61-70	133 (24.4)
70+	91 (16.7)
Residence	
Urban	430 (79.2)
Rural	113 (20.8)
Co-morbidities (N= 153)	
Diabetes mellitus	51 (33.3)
Cardiovascular diseases	26 (17.0)
Dyslipidemia	22 (14.3)
Arthritis	18 (11.7)
Peptic ulcer diseases	16 (10.4)
Asthma	16 (10.4)
Others	4 (2.6)
Level of adherence	
Adherent	465 (85.64)
Non-adherent	78 (14.36)
Adherent with controlled BP	414 (76.2)
Adherent with uncontrolled BP	51 (25.8)
Rate of BP control	
Controlled	481 (88.6)
Uncontrolled	62 (11.4)

participants for their willingness to participate in the research and contact information of the researchers were provided. Participation in the research was voluntary and no compensation was provided. Confidentiality of the data was maintained by not disclosing any personal details of the study participants.

Data analysis

The obtained data was entered into and analyzed by SPSS software version 20 for windows. Descriptive statistics including frequency, percentage, mean and standard deviations were done to describe sociodemographic variables. Binary logistic regression analysis was done to determine the predictors of UBP. A p-value of <0.05 was regarded as statistically significant in the regression models with 95% confidence interval to test the level of significance.

RESULTS

A total of 578 hypertension patients followed, 543 (93.9%) fulfilled the study criteria included in the final analysis. The mean age of the participants was 55.96 (SD=14.6). Female participants constituted nearly two-third (316, 58.2%) of the study population. The number of individuals aged older than 50 years accounted for (67.4%) of the respondents, and nearly (79.2%) of the patients were from urban areas. The mean systolic and diastolic BP level of participants was 138 (SD=11.2) and 87 (SD=5.6) mmHg, respectively. The prevalence of comorbidities was 28% (n=153) of which 33.3% were attributed to DM, other CVDs (17%) and 14.4% with dyslipidemia, respectively (Table 1).

Medication	Num. patients (%)
Hydrochlorothiazide	150 (27.62)
Enalapril+ hydrochlorothiazide	124 (22.83)
Hydrochlorothiazide + nifedipine	68 (12.52)
Enalapril	44 (8.10)
Nifedipine	30 (5.52)
Enalapril + furosemide	19 (3.50)
Atenolol + hydrochlorothiazide + Eealpril	18 (3.31)
Nifedipine + enalapril	17 (3.13)
Furosemide + spironolactone	16 (2.94)
Hydrochlorothiazide +atenolol	15 (2.76)
Atenolol + nifedipine	13 (2.40)
Amlodipine	10 (1.84)
Furosemide	7 (1.30)
Atenolol	4 (0.74)
Enalapril + hydrochlorothiazide + furosemide	4 (0.74)
Nifedipine + hydrochlorothiazide + enalapril	3 (0.55)
Amlodipine / nifedipine + furosemide	1 (0.18)

The vast majority (95.2%) of study participants were on mono-therapy and dual therapy. Hydrochlorothiazide is the most frequently prescribed mono antihypertensive medication with which 27.6% (n=150) of study participants were on. This is followed by enalapril (44, 8.1%) and nifedipine (30, 5.5%). On the other hand, the most frequently used dual therapy consisted of enalapril with hydrochlorothiazide (124, 22.8%), enalapril with furosemide (19, 3.5%) and nifedipine with enalapril (17, 3.1%). Similarly, 26 study participants (4.8 %) were on triple therapy where atenolol, hydrochlorothiazide and enalapril were combined for 18 of them (Table 2). More than one tenth (11.4%) of hypertensive patients experienced UBP status during their last visit.

The most significant determinant factors associated with the occurrence of UBP were shown in Table 3. Hypertensive patients with high salt intake were six times more likely to encounter UBP than those who took normal amount (adjusted odds ratio (aOR)=6.271 95%CI=[2.047-19.214]), controlling for other variables. Individuals between age group of 31 and 40 years (aOR=0.136 [0.029-0.650], 51-60 (aOR=0.261 [0.079-0.861] and >70 (aOR=0.249 [0.069-0.896]) had lower risk of UBP than those in the age group of 21-30. However, the number of regimen, sex, residence and comorbidities were not related with the incidence of UBP in a statistically significant manner (Table 3).

DISCUSSION

Target BP is difficult to achieve as different factors contributing for UBP and may lead to multiple end organ damages.⁷⁻⁹ This study determined the level of BP control and associated factors in a tertiary teaching hospital. It was found that there was a high level of controlled BP (88.6%) among hypertensive patients on treatment. Unlike these study findings, similar study conducted in Michigan reported that only small proportion of patients attained goal BP (38.2%). A large number of DM patients in the Michigan study (122) could be a reason for the variation between the two groups of patients.¹⁸ Another study also revealed the poorest rate of BP control among diabetics (55.8%) and renal impairment patients (18.1%).²⁹ About

Table 3. Determinant factors of uncontrolled blood pressure (UBP) in hypertensive patients				
Variable	UBP 62(11.4%)	Crude OR [95% CI]	Adjusted OR [95% CI]	p-value
Sex				
Male	29 (12.8)	1.256 [0.739-2.136]	1.490 [0.848-2.618]	0.307
Female	33 (10.4)	1	1	
Age group (years)				
21-30	5 (20.8)	1	1	
31-40	3 (4.5)	0.181 [0.040-0.828]*	0.136 [0.029-0.650]*	0.033
41-50	20 (23.3)	1.152 [0.381-3.476]	0.927 [0.290-2.961]	0.576
51-60	11 (7.7)	0.317 [0.099-1.012]	0.261 [0.079-0.861]*	0.022
61-70	15 (11.3)	0.483 [0.157-1.484]	0.346 [0.107-1.117]	0.961
>70	8 (8.8)	0.366 [0.108-1.245]	0.249 [0.069-0.896]*	0.041
Residence				
Urban	51 (11.9)	1.248 [0.628-2.481]	1.206 [0.579-2.512]	0.580
Rural	11 (9.7)	1	1	
Adherence				
Adherent	51 (11.0)	1	1	
Non-Adherent	11 (14.1)	1.333 [0.661-2.686]	1.637 [0.763-3.513]	0.626
Co-morbidity				
Yes	5 (22.7)	2.394 [0.851-6.736]	2.914 [0.935-9.084]	0.151
No	57 (10.9)	1	1	
Salt intake				
High	6 (35.3)	4.578 [1.630-12.856]*	6.271 [2.047-19.214]*	0.021
Optimal	56 (10.6)	1	1	
Dose				
Low dose	5 (12.5)	1.118 [0.421-2.969]	1.209 [0.426-3.433]	0.862
Normal	57 (11.3)	1	1	
Regimen				
Mono-therapy	22 (8.8)	1	1	
Dual-therapy	31 (13.4)	1.599 [0.897-2.852]	1.576 [0.852-2.912]	0.618
Triple- therapy	9 (14.3)	1.720 [0.750-3.945]	1.590 [0.658-3.840]	0.924

60% BP control was reported in Addis Ababa and concomitant DM and CKD were found to be associated with the lower proportion.⁶ Over three quarter of DM patients in South Africa failed to attain target BP.³⁰ BP control in other sub-Saharan countries was found to be below 30%.The discrepancy between the present study and the former studies could be due to the high level of non-adherence (54.2%) in the previous studies versus 14.3% in this study (Table 3).³¹

Studies conducted in Kenya stated that male sex was strongly associated with the high incidence of UBP. But, in this study gender was not related with UBP.³² In addition, it is evident in this study that the patients' level of adherence to antihypertensive medication was not implicated with the occurrence of UBP. But, other study findings indicated non-adherent patients have experienced higher incidence of UBP than their counter parts.¹⁵ Dave *et al.* also suggested that non-adherence with medications was significant predictors of uncontrolled HTN.³³ Another study reported significant variation in the level of BP control among adherents and non-adherents.³⁴ This inconsistency might be due to the involvement of the patients in alternative non pharmacologic hypertensive therapy or lifestyle modifications such as exercise and Dietary Approaches to Stop Hypertension (DASH) therapy.³⁵

The coincidence of comorbidities such as DM, heart failure and CKD were frequently observed in HTN patients. These ailments are found to contribute for progression of HTN by involving in its pathogenesis, although no hypothesis has been able to elucidate the clear mechanism of the development of HTN from these comorbidities as the majority of the presentation is classified as primary. In the present study, the coincidence of HTN with other

comorbidities was not statistically associated with the occurrence of UBP. This discrepancy could be due to the early detection, control and appropriate management of comorbid conditions. Management of HTN relies on the proper handling of these illnesses. For this, experts have prepared a lower cut-off point of BP for DM, CKD and Coronary Artery Disease (CAD). The drug selection was also based on the presence of comorbidities commonly called "compelling indication" and targeting the lower cut point during management process of HTN in these special population with the most appropriate regimen is associated with low incidence of UBP and its complications.¹ The appropriate treatment of comorbidities could substantially reduce their impact on BP. For instance, strict glycemic control and slow progression of CKD reduces the vascular damage and fluid retention, respectively. Hence, despite the occurrence of comorbidities it could be reasonable to see tight BP control as long as the comorbid conditions is adequately managed. In addition to this, exposure of patients to medication to treat these comorbidities would probably increase their experience of complying with instructions, coping with side effects and dealing with polypharmacy.³⁶ This justification is supported by the finding of large number (>75%) of adherent and controlled cases in this study despite 28% of comorbidities. Another study revealed that duration of antihypertensive drug use and morbidity count had significant associations with BP control.³⁷

The amount of dose was not found to be related with the incidence of UBP. Due to fear of side effects clinicians usually start their patients with lower effective pharmacologic dose of antihypertensive drug. Based on the response and tolerability of the side effects, doses could be escalated. However, patients are usually non-responsive for

this dose. They need either additional dose or additional drug. Based on the JNC-7 patients whose current medication is not working should receive either high dose or new regimen on top of the previous medication.¹ The lack of difference in response between patients who took lowest effective dose and normal therapeutic dose could be placement of significant number of patients on more than one drug (42.5%) and triple therapy (11.6%) that might acquire synergistic activity even though their dose is the lowest possible.³⁸ Meta-analysis finding indicated that, the amount of sodium could attribute for UBP by retaining water and increasing the cardiac output (CO). BP is the product of CO and peripheral resistance. If CO increases, it increases BP. During their investigation Ha stated that salt was strongly associated with elevated BP. Patients with low average daily salt intakes had low BP.⁹ This study has also demonstrated that high amount of salt intake increased the incidence of UBP nearly six times as compared to optimal dose. WHO advocated to reduce dietary salt intake to lower incidence of non-communicable disease burden and called nations to take action to reduce population wide dietary salt intake especially in elderly patients that are more salt sensitive.⁹ In Ethiopia salt is added in most of the food items during dish preparation. Hence, patients could face difficulties to optimize the recommended dose of daily salt allowance of nearly 6 g unless they are strictly advised by the health care professionals.¹⁵ Middle aged and elderly individuals experienced lower rate of elevated BP than their young counter parts. This could be the low level of awareness and medication experiences in the young patients. A study on Chinese hypertensive subjects indicated that old age and long standing hypertension were associated with high level of adherence while adherence in turn was associated with controlled BP.³⁹ In the present study, the common order of medication prescribed for the patients were, dual therapy and mono-therapy followed by triple therapy. This pattern was comparable with a finding reported by Oliveira-Filho *et al.* study in which antihypertensive mono-therapy was prescribed to 47.1% of patients whereas 45.3% and 7.1% were taking two and ≥ 3 drugs, respectively. In this study, antihypertensive mono-therapy was prescribed to 45.1% of patients whereas 50.1% and 4.8% were taking dual and triple drugs respectively.⁴⁰ The present study provided valuable information on the

level of BP control and its predictors in developing country. Nonetheless, it was not without limitations. The study was a mono-center study. Therefore, rigorous evaluation of potential predicting factors from different population at community level is required. Hence, authors recommend another community based multi-center studies incorporating large number of subjects.

CONCLUSIONS

In conclusion, BP control was relatively higher in the set-up. High salt intake was an important determinant factor of UBP. Middle to old age groups were associated with low incidence of UBP. However, the level of adherence, sex, number of antihypertensive medications and amount of dose didn't affect the extent of BP control. The chronic illness department of the tertiary hospital should consider establishing a counseling unit on non-pharmacologic alternatives for chronic diseases management and should link patients to this unit so as to optimize high salt intake. The Ministry of Health of Ethiopia should work to increase the level of understanding of the population towards the consequences of high salt intake. This study demonstrated possible predictors of UBP. The findings of the study would be very important in counter acting risk factors by giving attention and priorities to the most responsible factors.

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CONFLICT OF INTEREST

None.

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